



Pebble Project
NORTHERN DYNASTY MINES INC.

**DRAFT ENVIRONMENTAL BASELINE STUDIES
2004 PROGRESS REPORTS**

CHAPTER 19. DATA MANAGEMENT

NOVEMBER 2005

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ACRONYMS

AASHTO	American Association of State and Highway Transportation Officials
ABA	acid-base accounting
ac-ft	acre-feet
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
agl	above ground level
AHRS	Alaska Heritage Resource Survey
ALS	ALS Environmental Laboratory
ANCSA	Alaska Native Claims Settlement Act
AP	acid potential
APE	area of potential effect
ASCI	Alaska Stream Condition Index
ASTM	American Society for Testing and Materials
ASTt	Arctic Small Tool tradition
BBNA	Bristol Bay Native Association
BEESC	Bristol Environmental & Engineering Services Corporation
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BP	before present
BTEX	benzene, toluene, ethylbenzene, and xylenes
°C	degrees Celsius
¹⁴ C	Carbon 14
CEMI	Canadian Environmental and Metallurgical Laboratory
cfs	cubic feet per second
CIRCAC	Cook Inlet Regional Citizens Advisory Council
cm	centimeter(s)
CPUE	catch per unit effort
CQ	continuous flow
CRM	cultural resources management
CUEQ%	copper equivalent grade
DEM	digital elevation model
DI	deionized
DOT&PF	Alaska Department of Transportation and Public Facilities

DRO	diesel-range organics
EBD	environmental baseline document
EIS	environmental impact statement
EPT	Ephemeroptera, Plecoptera, or Trichoptera
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FL	fork length
fps	feet per second
ft	foot (feet)
ft ²	square foot (feet)
g	gram(s)
GIS	geographic information system
GLM	general linear model
GMU	Game Management Unit
gpm	gallons per minute
GPS	global positioning system
GRO	gasoline-range organics
GS	gauging station
HC-3	high-gradient, contained channel
HDR	HDR Alaska, Inc.
HGM	hydrogeomorphic
HWM	high-water mark
ICP	inductively coupled plasma
IIE	Iniskin/Iliamna Estuary
IQ	instantaneous flow
KC	Kaskanak Creek
kg	kilogram(s)
km ²	square kilometers
KP	Knight Piesold
KR	Koktuli River Main Stem
L	liter(s)
LC-1	low-gradient, contained channel
LIDAR	light detection and ranging
m	meter(s)
m ²	square meter(s)
M.A.	Master of Arts
MC-1	moderate-gradient, narrow, shallow, contained channel

MCHTWG	Mulchatna Caribou Herd Technical Working Group
MDC	mine development concept
MDL	method detection limit
me-Hg	methyl-mercury
MEND	mine environment neutral drainage
mg	milligram(s)
mi ²	square mile(s)
ml	milliliter(s)
ML/ARD	metal leaching/acid rock drainage
MLLW	mean lower low water
mm	millimeter(s)
MM-1	moderate-gradient, mixed-control channel
MMS	Minerals Management Service
MODIS	moderate resolution imaging spectroradiometer
mph	miles per hour
MRL	method reporting limit
m/s	meters per second
µg	microgram(s)
µL	microliter(s)
µmhos	micromhos
NASA	National Aeronautics and Space Administration
ND	non-detect
NDM	Northern Dynasty Mines Inc.
NEPA	National Environmental Policy Act
ng	nanogram(s)
NK	North Fork Koktuli River
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NP	neutralization potential
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
Nv	calculated variance
NWR	National Wildlife Refuge
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OHMP	Office of Habitat Management and Permitting
OHW	ordinary high water
PA-1	narrow, placid-flow habitat

PA-3	shallow-ground, water-fed slough
PA-5	palustrine beaver habitat
PAG	potentially acid-generating
PJD	preliminary jurisdictional determination
PSD	Prevention of Significant Deterioration
PVC	polyvinyl chloride
Q	discharge
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RBP	Rapid Bioassessment Protocols
RDI	Resource Data, Inc.
RRO	residual-range organics
SHPO	State Historic Preservation Officer
SK	South Fork Koktuli River
SLR	SLR Alaska
SRB&A	Stephen R. Braund & Associates
SRK	SRK Consulting (Canada) Inc.
SVOC	semivolatile organic compound
SWE	snow/water equivalent
3PP	Three Parameters Plus
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
UAF	University of Alaska Fairbanks
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UT	Upper Talarik Creek
VHF	very high frequency
VOC	volatile organic compound
WMC	Water Management Consultants Inc.
WRIR	water-resources investigations report
WY	water year

19. DATA MANAGEMENT AND GIS

19.1 Introduction

This section presents the 2004 results of the data management and geographic information system (GIS) program currently in progress at Resource Data Inc. (RDI) for the Northern Dynasty Mines Inc. (NDM), Pebble Project. The GIS and scientific data generated as part of the permitting process are valuable assets to NDM. In the short term, NDM must make the data available to the environmental-baseline project team. In the long term, NDM must maintain the data to support the requisite environmental impact statement and permitting process and ultimately to support the monitoring of Pebble Mine activities throughout the life of the project. A sound data management strategy assures that the data are accurate, timely, and integrated into a multidisciplinary database.

RDI's data management solution is completely automated. This automated system helps eliminate errors caused by manual editing and analysis of scientific data. This methodology was used to define clear requirements for data deliverables and to provide data sources with the necessary tools to verify compliance with these requirements prior to delivery.

RDI's primary scope of work consists of the following activities:

- GIS work.
- Website and data management.

The GIS work covers managing all mapping data collected during baseline studies, creating and loading base-map and Pebble-specific data, supplying GIS support for the wetlands study, and providing cartographic services to support the entire project. Website and data management includes building a central data repository for the project, providing web-based tools to enter and report on project data, and developing tools to upload data into the project database. The website and database are being designed to provide long-term storage and access to baseline data throughout the projected 50-year life of the mine.

19.2 Program Objectives

The objectives of 2004 GIS activities were as follows:

- Develop standards for spatial data including datum, projection, and accuracy.
- Compile base-map data.
- Compile 2004 study data.
- Distribute data to all investigators.

The objectives of 2004 activities related to website and data management were as follows:

- Establish standards for data format, content, and transfer.
- Support 2004 field operations through the development of web-based software for data entry, document management, project management (calendar, logistics tools, etc.), and mapping.
- Support data analysis and reporting.
- Manage documents.
- Ensure NDM ownership of system hardware, software, and data.

19.3 Scope of Work

19.3.1 GIS

RDI's scope of services included developing GIS standards, building a GIS to support the permitting process, and providing GIS support to NDM and its contractors. The activities outlined below have been completed.

19.3.1.1 GIS Management

RDI created standards for managing the GIS data associated with the Pebble Project. Standards included creating or defining types and versions of software to be used, spatial data-naming conventions, standard projection, standard map templates, metadata requirements, and map and data transfer procedures.

The standard mapping software used in Pebble is ESRI ArcGIS 8.3. This ensures that all figures and maps produced for the project are compatible. Data-creation software is up to the individual consultants as long as the resulting data are 100 percent compatible with ArcGIS 8.3.

Standard map projection for the project is Alaska State Plane Zone 5 using the 1983 North American Datum.

Data storage and naming conventions include the following:

- All GIS data are stored in the GIS_FINAL folder.
- Data inside of GIS_FINAL are stored in subfolders named by a three- or four-character abbreviation of data originator.
- Inside of the data originator subfolders, consultants create CATEGORY folders at their discretion.
- All SHP-file (shape-file) names are limited to 13 characters and must contain a version number. An example is hydro_V02.
- Data are stored in ESRI SHP file format.

All data must have metadata populated using the ESRI metadata tool set.

Standard map templates for use by the project team also have been created. The templates were created as ArcGIS MXT files. They include the following:

- 8 ½" X 11" Portrait.
- 8 ½" X 11" Landscape.
- 11" X 17" Portrait.
- 11"X 17" Landscape.
- 24" X 36" Landscape.
- 35" X 50" Landscape.

RDI keeps the master GIS data repository and coordinates all data transfers from RDI to project consultants via portable hard drives or via the project data management website described in Section 19.3.2

19.3.1.2 Compile Base-map Data

RDI compiled base-map data for use by the project team. All data were converted from their native format for use in ArcGIS 8.3. Data include the following:

- U.S. Geological Survey (USGS) 1:63360 Digital Line Graph (DLG) hydrography.
- Fifty-foot contours generated from USGS 1:63360 Digital Elevation Models (DEMs).
- Hand-entered geographic labels and waterbody labels from USGS Digital Raster Graphs.
- 1:2400-scale ortho-photography for the inner mine area developed by Eagle/Kodiak Mapping.
- 1:2400-scale vector mapping for the inner mine area developed by Eagle/Kodiak Mapping.
- 1:2400-scale Lidar mapping produced by Eagle/Kodiak mapping developed for the inner mine area.
- 1:4800-scale ortho-photography for the outer mine area developed by Eagle/Kodiak Mapping.
- 1:4800-scale vector mapping produced by Eagle/Kodiak mapping developed for the outer mine area.
- Township, range, and section information.
- National Parks and Preserves data.
- Native regional corporation boundaries
- 1:2400-scale ortho-photography for the road corridor developed by AeroMap U.S.
- 1:2400-scale Lidar mapping produced by AeroMap U.S.

19.3.1.3 Load Pebble Data

RDI processed 34 individual mine development concepts and 7 road and port preliminary design concepts for the project. The mine design concepts were delivered to RDI from Knight Piesold in AutoCAD format. Upon receipt of the mine designs, RDI converted the data to polygonal ESRI SHP files for use in potential impact assessment and distribution to consultants. Road and port design concepts were delivered to RDI from PND Inc. as AutoCAD files. RDI converted the data into ESRI SHP files for use by the consultants.

19.3.1.4 Environmental Data

RDI gathered and converted various environmental data sets into ArcGIS 8.3 for the Pebble Project. In some cases data only existed in paper format and were digitized. Data sets include the following:

- Anadromous fish streams.
- U.S. Fish and Wildlife Service (USFWS) caribou habitat.
- Alaska Department of Fish and Game habitat mapping, including bear habitat, bird habitat, caribou habitat, clam habitat, crab habitat, fish habitat, marine mammal habitat, moose habitat, and sheep habitat.

19.3.1.5 Data Acquisition for Three Parameters Plus and Others

RDI acquired and processed data sets for use by Three Parameters Plus (3PP) and other environmental consultants. Certain data sets only existed in paper form and required digitizing. All data were converted into ESRI SHP format. Data include the following:

EPA-9498-0000182

- Surficial geology.
- USFWS National Wetland Inventory (NWI).
- National Resource Conservation Service soil maps.
- USGS Earth Resources Observation Systems (EROS) Bristol Bay land cover.

19.3.1.6 Ongoing support for 3PP and Others

RDI supports 3PP and HDR Alaska, Inc., in the wetlands delineation process. The following activities were completed in 2004:

- Produced field maps and photo reports—RDI created field maps on Rite in the Rain paper for use by 3PP and HDR during the field season.
- Wetlands data scrubbing—RDI scrubbed wetlands data to remove slivers and close polygons and to maintain the integrity of the wetlands mapping.
- Processed photos and photo location information—HDR and 3PP delivered their digital photographs and location information to RDI for processing into the wetlands application described Section 19.3.2.5.
- Provided analysis of mapping—RDI provided 3PP with summary tables showing acres disturbed by vegetation type and hydrogeomorphic (HGM) classification.
- Impact analysis of alternatives—RDI provided data tables of potential impacts of mine development concepts. Data tables were generated by intersecting potential mine designs with environmental GIS data and creating tables which contained impact of habitat by species.

19.3.1.7 Cartographic Services

RDI provided cartographic services to the project team on an as-needed basis. Maps were typically for internal project meetings or agency meetings. Over 100 individual custom maps or variations of maps have been produced for the NDM team.

19.3.2 Data Management

RDI created a web-based data management application. The website is a secure site with varying levels of internal security. The role-based security allows different types of functionality based on a user's log-in. This document is a summary of functionality present in the system.

19.3.2.1 Document Repository

A document repository was created which allows members of the Pebble project team to share digital documents. The repository allows users to upload and download any type of digital file. Document information is captured via user-entered metadata and is tracked by version number. Role-based security determines user privileges for adding, viewing, editing, and deleting files. Because it is expected that the repository will hold a large number of documents, search functionality was created so that users could enter specific criteria to target specific documents and document types. Files are stored within folders and displayed in a “collapsible” tree-view allowing for easy viewing and retrieval of documents (Figures 19-1 and 19-2).

19.3.2.2 Calendar

RDI developed a project calendar for use by the project team. The calendar has two views: project team view and NDM management team view. A user has access to one or both calendar views based on their login. The calendar allows users to schedule meetings, set recurring meetings, and attach digital documents to meetings (Figure 19-3).

19.3.2.3 Contacts

A project team contact list was created. The list is generated dynamically and is updateable by administrators. The contact list (Figure 9-4)—exportable to Microsoft Excel—captures, stores, and reports the following information:

- Name.
- Title.
- Phone Number.
- Fax Number.
- Email Address.
- Area of Expertise.
- Company.
- Company Description.
- Address.

19.3.2.4 Logistics

RDI created a series of logistics forms to support the project. Logistics information includes the following:

- Emergency Procedures—Lists contact information and procedures to follow in the event of an emergency (Figure 19-5).
- Helicopter Request Form—Allows users to enter information to schedule helicopters for field work (Figure 19-6).
- Bear Guard Support Form—Allows users to enter information for scheduling bear guard support when conducting field work at sites where wildlife could pose a potential threat to team members (Figure 19-7).

19.3.2.5 Wetlands

The wetlands application allows certain users to enter field information on wetlands and to create reports using this information. The application stores all information related to the wetlands program, including field data, site location maps, and digital photographs of each wetland plot location.

Primary input for wetlands information is accomplished using the Jurisdictional Wetlands Input Form. The input form allows users to enter applicable information based on the following sections:

- Site Location—Information relating to the location of an individual field plot including a site location map (Figure 19-8).
- Vegetation—Information relating to the vegetation located at a field-plot location (Figure 19-9)84

- Hydrology—Information relating to the hydrology present at a field-plot location (Figure 19-10).
- Soil Profile—Information relating to the soil profile present at a field-plot location (Figure 19-11).
- Other Soil—Additional information on the soil present at a field-plot location (Figure 19-12).
- Determination—Final information on whether or not the field plot is a wetland; also allows for storage of multiple digital photographs of the field plot and surrounding area (Figure 19-13).
- Assessment—if the wetland is designated as a wetland on the Determination tab, an Assessment tab will appear, allowing the user to select from a pre-defined list of wetland variables (e.g., hydrologic, landscape, and vegetation variables; Figure 19-14).

Wetlands reports include the following:

- Jurisdictional Wetland Plot Report—Retrieves all data related to a specific wetland field plot and displays a comprehensive report with detailed information on vegetation, hydrology, soil profiles and indicators, determination, and assessment (Figures 19-15 and 19-16).
- Master Plant-list Report—Allows a user to search for plant types by watershed and firm. Report is exportable to MS Excel (Figure 19-17).
- Jurisdictional (JD) Wetland Determination Photo Report—Provides photos and basic information about a wetland plot including location, soils, hydrology, and dominant plants by stratum. Report is exportable to MS Word (Figure 19-18).
- Plant Community Report—Allows user to search for plant life based on a variety of criteria. Report includes information on species location, composition, soil horizon, and wildlife observations in a specified range. Entire report is exportable to MS Word with some table sections exportable to MS Excel (Figure 19-19).
- Functional Assessment Models—Eight models used to determine functional capacity of a wetland as described in *A Rapid Procedure for Assessing Wetland Functional Capacity, Based on Hydrogeomorphic (HGM) Classification* (Magee, 1998). The models run in an automated format based on user input and administrative settings. Model results are exportable in MS Word format (Figure 19-20).

19.3.2.6 Links

Links are provided to relevant web-based resources for associations, publications, and government and regional agencies (Figure 19-21).

19.3.2.7 Field Forms

Field forms were developed to capture information relating to studies conducted during the 2004 and 2005 field seasons. Data captured in these forms will be exportable to MS Excel for future analysis. Forms include the following (Figure 19-22):

- Water Quality Monitoring.
- Habitat Assessment.
- Diatom Live/Dead Count.
- Diatom Identification.
- Subsampling.

- Physical Characterization.
- Benthos/Water Quality.
- Chironomidae ID.
- Periphyton Field Data Sheet.
- Periphyton Sample Lab Processing Sheet.
- Sample Login Sheet.
- Sample Login/Tracking Sheet.
- Spawning Count
- Removal Form
- Identification
- Iliamna Lake Study
- Macroinvertebrate/Periphyton/Water Quality

19.3.2.8 Analytical Data

The analytical data application contains a generic data loader which is user configurable. The data loader checks incoming data for a variety of problems such as duplicate sample numbers, missing rows within a column, previously loaded samples, etc. It is composed of the following functionality (Figure 19-23):

- Create New Data Loader—Allows users to create a new data loader for the system. The data loader controls the electronic data definition (EDD), which specifies the format of the columns to be added to the database.
- Edit Data Loader—Provides the ability for users to edit an existing data loader (Figure 19-24).
- Delete Data Loader—Removes a data loader from the system.
- View Loader History—Allows users to search through a history log of all data loaded to the system (Figure 19-25).
- Load Data—Allows users to load analytical data to the system in the format specified in the electronic data definition.
- Reload Data—Allows users to reload data which has been loaded to the system previously.
- Data Extractor, Run Existing Report - Allows user to run an existing report by selecting the columns to display and performing simple filtering on those columns using boolean operations
- Data Extractor, Define New Report - Allows user to define a new report by binding metadata with a Oracle view.
- COC List Reports - Allows users to access filter page and result screen for reporting COC Header information (Date, Company, Location, etc.)
- COC Details Report - Allows users to access filter page and result screen that shows all COC samples collected.
- COC Sample Exception Report - Report that shows samples that are on the COC, but are not in the laboratory reported samples.
- COC Lab Analysis vs. Requested Method - Report that shows samples whose tested methods differ from the field requested methods.

19.3.2.9 GIS Map

The GIS map is an interactive web-based mapping application. It allows users to view GIS data which has been collected and generated for the Pebble Project (Figure 19-26).

19.4 Technologies Used

19.4.1 GIS Technology

The Pebble Project GIS is based on ESRI technology.

- ArcView 3.3 is used for habitat mapping.
- ArcGIS 8.3 is used for all other functionality, including map production and data creation.
- Vector data are stored as ESRI shape files.
- Raster imagery is stored as Geotiffs with ESRI pyramids.
- Data are distributed via portable hard drives or the project website.
- Web-based GIS is developed on ArcIMS 9.02.
- All GIS data are documented using the metadata tools in ArcGIS.
- Standard map projection is Alaska State Plane Zone 5 Feet.
- Datum is 1983 North American Datum.

19.4.2 Data Management Technology

The project website was developed using the following technologies:

- Oracle 10g.
- Microsoft Advanced Server 2003.
- Microsoft Internet Information Server.
- Microsoft C#.NET.
- Dell Poweredge 2600 XEON Server.

19.5 References

Magee, D.W. 1998. A Rapid Procedure for Assessing Wetland Functional Capacity, Based on Hydrogeomorphic (HGM) Classification. Bedford, NH. Normandeau Associates.

FIGURES

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The screenshot shows a Microsoft Internet Explorer window displaying the Northern Dynasty Mines Inc. - Pebble Project website. The main menu includes Home, Document Repository, Calendar, Contacts, Logistics, Wetlands, Links, Analytical Data, Admin, and Logout. On the left, a navigation tree under 'Pebble Documents' lists various document types such as Contracts, EDO Templates, Labels, Maps, coverport, Specimens, SPP, ABR, ADFG, ADNR, ADOT, AERO, BEES, EAN, CH2, EAGM, Fish Data, FVGS, HDR, IRON, RD, NRCS, RDA, XPS, SLR, USDA, and USGS. The central area displays a table titled 'Options' with descriptions for Uploading files, Adding server files, and Deleting files. Below this is a table titled 'Directory: SpatialDataRD\dictbx' showing three files: ph_1041.sdb.zip, ph_1041.sdb.zip, and ph_151.sdb.zip, each with its title, size, company, view version, add version, and delete options.

FIGURE 19-1. Document Repository, Files List

The screenshot shows a Microsoft Internet Explorer window displaying the Northern Dynasty Mines Inc. - Pebble Project website. The main menu and navigation tree are identical to Figure 19-1. The central area displays an 'EditDocument' form with fields for Title (10,000 scale grid), Date (11/22/2004), Author, Call Number, Document Type (ODS Des), RFI Number, Publisher, Pub Source, Publication Date (11/22/2004), Report Number, Record Number, Format, Sponsor, Keywords, Citation, Annotation, Abstract, and Comments. At the bottom of the form are Save, Exit, and Delete buttons.

FIGURE 19-2, Document Repository Metadata Form

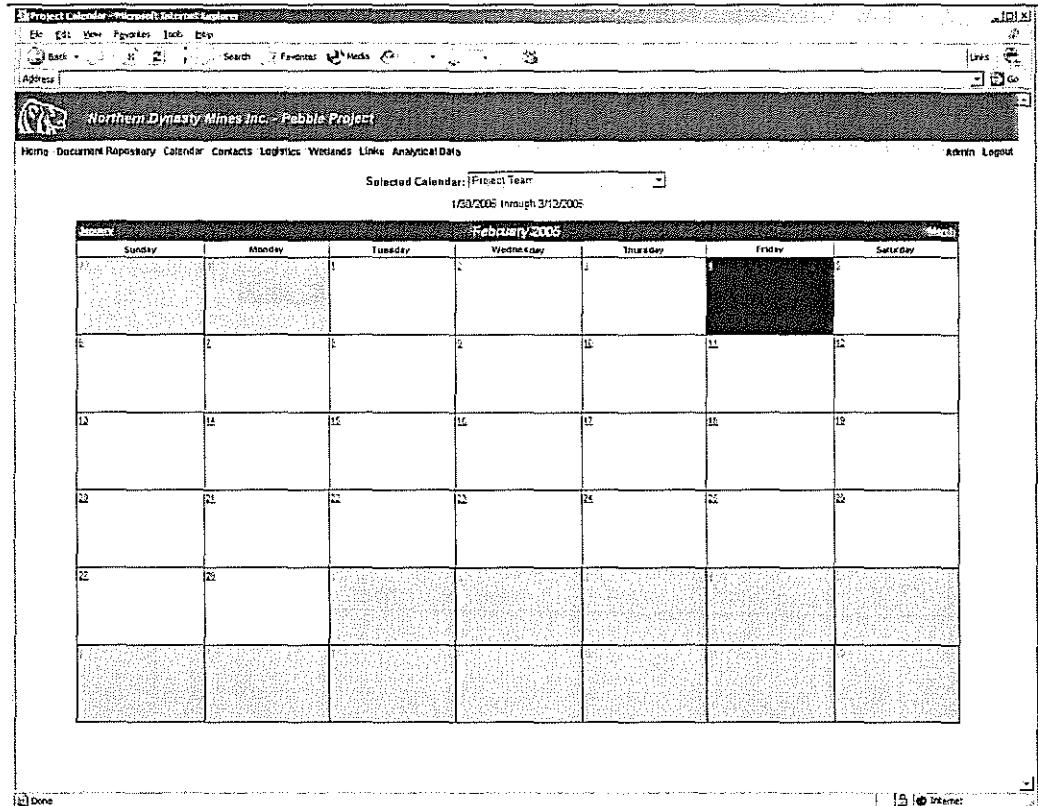


FIGURE 19-3, Calendar, Project Team View

Select Contact Group: Project Team - Compact View						Add New	Excel View
Full Name	Phone	Phone Alt	Fax	Email	Area Of Expertise		
John Henningsen	907-770-4100		907-561-0159	jhenningsen@northerndynasty.com	GIS / Data Management		
Lynn Zutz	339-2600		339-2601	lynnz@northerndynasty.com			
Brandi Bland	907 644 2024	907 274 2000		brandi.bland@norndyn.com	Wetlands		
Angie Gekler	(907) 339-2600		(907) 339-2601	angieg@northerndynasty.com	Community relations, corporate communication		
Ashley Birka	339 2600		339 2601	ashleyb@northerndynasty.com			
Heidi Farnham	339 2600		339 2601	heidif@northerndynasty.com			
Terry Schuck	907 344 6777		907 770 1443	terry.schuck@norndyn.com	Terrestrial Wildlife		
Steve Murphy	907 455 6777			smurphy@norndyn.com	Project Manager (ABR)		
Sam Barber	907 243 9584		907 243 4294	shuber@plazatek.net	Surface Water - Road Port		
Colette MacCay	907 563 0013		907 563 6713	cmacca@teetecc.com	Permitting Support		
Patricia Cole	907 563 0013		907 563 6713	pcoll@teetecc.com	Ground Quality - Road Port		
Greg Reischer	907 563 0013		907 563 6713	g.reischer@teetecc.com	Project Mgr (Bristol) Community Education/Training		
Jim Buel	603 203 1248		603 203 0240	jbuell@unisys.com	Fish & Acoustic Habitat		
Ned Purkey	604 942 5551		604 942 5551	ned.purkey@eaglemonitoring.com	Aerial Photography/Mapping		
Tom Rummel	604 665 0543		604 665 0147	tom.rummel@unisys.com	GeoTechnical		
James Colgate	604 665 0543		604 665 0147	jcolgate@unisys.com	GeoTechnical		
John Mihell	907 345 8212		907 345 8212	nmihell@norndyn.com	Fish & Acoustic Habitat QA/QC		
Sean MacPhee	604 647 2962	604 767 2962 - cell	604 662 4503	smp@norndyn.com	Management Consultant		
Doug Puryear	907 770 4129		907 561 0159	dpuryear@norndyn.com	GIS/DATA Management		
Dan Peegan	907 770 4105		907 561 0159	danpeegan@norndyn.com	GIS/DATA Management		
Craig Adam	907 770 4127			craig.adam@norndyn.com	GIS/DATA Management		
Steven Crum	907 562 2343		907 561 5301	scrum@environmental.com	Project Mngr (SGS) Water Quality Laboratory Analysis		
Chuck Hooperstead	907 562 2343		907 561 5301				

FIGURE 19-4, Contacts

Northern Dynasty Mines Inc. - Pebble Project		Northern Dynasty Emergency Procedures	
Home Document Repository Calendar Contacts Logistics Wellsites Links Analytical Data			
Admin Logout			
Emergency Contact Information			
Project Executive Emergency Medical Services		Project Executive Emergency Medical Services Ambulance/Hospital / Air Ambulance	
Back To Top			
Emergency Contact Information			
Do Iarmna Weathered Inn: #1 Redoubt Rd., Suite 124 Iliamna, AK 99632 Tel: 907-571-1780 or 1774 Fax: 907-571-1788 Email: pebble@doil.com		1030 - 800 West Peniel Street Vancouver, B.C. Canada V6C 2V6 Tel: 604-854-6394 Toll Free: 1-800-557-2114 Fax: 604-667-8993	
Pebble project field office in Iliamna: Telephone: 907-571-1782 (this line has voice mail and call waiting) Fax: 907-571-1783		John and Sally Daechler: Daytime: @ Weathered Inn: 907-571-1774 Home: @ Iliamna Lake Lodge: 907-571-1663	
Project Executive in Anchorage: On-Line Exploration Services - Kevin Adler Tel: 907-345-4815 Cell: 907-440-1558		Vancouver Office Contact: Shirley Mann - office number as above or Home: 604-684-0165 Cell: 604-850-2444 Richard Haslinger - office number as above or Home: 604-975-6103 Cell: 604-779-0755	
Back To Top			
Physical Location			
Northern Dynasty Minerals: Iliamna Weathered Inn South end Iliamna Air Strip Iliamna, AK 99632		Iliamna Inn Coordinates: 59° 45' 195" North 154° 54' 515" West	
		Drill Area Coordinates (general): 69° 53' 10" North 155° 19' West	
Back To Top			
Emergency Medical Services			
Iliamna Clinic Tel: 571-1383 Clinic Location: Roadhouse Strip 59° 45.254 North Renz's Garage home phone: 571-1383 154° 45.726 West		Back To Top	
Medical Emergency Procedure:			
1) Contact NDM Base Camp in Iliamna by telephone (1-907-571-1788), or radio. Radio frequency being used is 151.625 with a 123.000 MHz transmit and receive tone (private line). 2) Contact ALASKA STATE TROOPERS Dispatch: (907) 428-7200 For a major emergency you should contact the ALASKA STATE TROOPERS Dispatch at (907) 428-7200 (24 hrs)			
The Alaska State Troopers will then mobilize the appropriate level of response, including contacting the local State Trooper, medical and rescue personnel (including military). The Alaska State Troopers are the equivalent of the RCMP			
Back To Top			

FIGURE 19-5, NDM Emergency Procedures

Help | Favorites | Tools | Help

Back | Forward | Home | Search | Favorites | Help

Address:

Northern Dynasty Mines Inc. - Pebble Project

Home Document Repository Calendar Contacts Logistics Wetlands Links Analytical Data Admin Logout

Form Type: **Request** [Cancel](#) [Save](#) [Print](#) [Email](#) [Logout](#)

Saved Request: **[06/05/2004]** [\[Edit\]](#)

Purpose: [\[Edit\]](#)

Date of Request Submission: **[06/05/2004]** [\[Edit\]](#)

Person Requesting Services and Contact Information:

Name: [Name]	Email: [Edit]	Phone: [Edit]
First: [Edit]	Last: [Edit]	Middle: [Edit]

Company/Project Task:

Data Services are Requested:

Scopes of Services Requested:

Number of personnel traveling and company affiliation covered under this request:

Special Requirements (Incl. weight of heavy vehicles/trailers)

Comments:

FIGURE 19-6, Helicopter Request Form

Northern Dynasty Mines Inc. - Pebble Project

Home Document Repository Calendar Contacts Logistics Wetlands Links Field Forms Analytical Data Admin Logout

Form Type: Bear Guard Support

Saved Requests: New Request

Purpose:

Date of request submission: 11/14/2005

Person Requesting Services and Contact Information:

Edit	Delete	Name/Company/Title	Email	Phone
Update	Delete			
Cancel				

Add

Company/Project Task:

Date Services are Requested:

Scope of Services Requested

Number of personnel traveling and company affiliation covered under this request:

Edit	Delete	Name	Company	Arrival	Departure	Notes
Update	Delete					
Cancel						

Add

Special Requirements (Include weight of heaviest/bulkiest pallet):

Done Internet

FIGURE 19-7, Bear Guard Support Form

WetlandsFormingMain - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Plot is read only.

Project/Site: Pebble Project

Photo Date: 6/27/2004

Summary Date: 6/27/2004

Applicant/Owner: Northern Dynasty Minerals, Inc.

County: Lake & Peninsula Borough

Investigator 1: SR : Steve Redman (3PP)

State: WISCONSIN

Investigator 2: CK : Cal Kerr (3PP)

Watershed: South Fork Kokonui

Investigator 3: []

Community ID: []

Do Normal Circumstances Exist? Yes

Paper Plot/Tie No: []

Is the Site Significantly Disturbed (atypical)? No

Ortho No: []

Is the Site a Potential Problem Area? No

Air Photo No: []

Approximate Distance to Nearest Disturbance (ft): []

Township: [] (gps)

Type of Disturbance (if any): []

Range: [] (gps)

General location: []

Section: [] (gps)

Quad No: [] (gps)

Stream Crossing: []

Water Body: []

Reference Data: []

Functional Assess: []

Uplands: []

Trans. Upland: []

Wetlands: []

Trans. Wetland: []

Rep. Upland: []

Rep. Wetland: []

SH_Upland: []

SH_Wetland: []

SH_Trans. Wetland: []

SH_Trans. Upland: []

SH_Potent: []

0003

100 200 Feet

Plot 5 of 4688

Unlock Plot

<< previous | 1 | next >>

Go To Next Tab

Done Internet

FIGURE 19-8, Site Location Tab, Jurisdictional Wetlands Input Form

3 WetlandsformInputMain - Microsoft Internet Explorer

File Edit View Favorites Tools Help

ISPP0002 | Data Entry Complete | N-T

[SPP] Go JD

Site Location	Vegetation	Hydrology	Soil Profile	Other Soil	Determination	Save Plot	Main Menu		
Acronym	Latin Name	Common Name	Stratum	Ind. Status	% Cover	Dom.	Tree Height	Tree DBH	Magee Stratum
ALSI	Aibus sinuata (shrub)	Sedge elder (shrub)			30	Y			
BEGL	Betula glandulosa	Tundra dwarf birch			5	N			
ISAPL1	Salix pulchra	Diamond-leaf willow			30	Y			
IVAVI	Vaccinium vitis-idaea	Mountain cranberry			10	N			
ICACA	Calamagrostis canadensis	Blue-joint reedgrass			10	Y			
EPANI	Erythronium angustifolium	Fireweed			10	Y			
EQAR	Equisetum arvense	Field horsetail			5	Y			
IREU	Trientalis europaea	European starflower			10	N			

of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 80 Calculated: 80 % Calculate

Project Veg Type:

Field BBMP Veg Type: Open Alder-Willow Tell Shrub (D6)

Field JD Wet Code:

Field ENM Code:

Field EROS Veg. Type:

Eros GIS: Open Alder-Willow Tell Shrub (D6)

Trace <= (%) 3 Method: 50/20-Stratum

% by Stratum (Magee - Wetlands Only)

TREE = Canopy	0 %	SAP = Sapling	0 %
SS = Short Shrub	35 %	DS = Dwarf Shrub	10 %
SH = Short Herb	28.5 %	ML = Moss-Lichen	0 %
SUB = Submerged	0 %	F = Floating	0 %

Number of Layers: 4

Plot 4 of 4666 << previous 1 next >> Go To Next Tab

[Done] Internet

FIGURE 19-9, Vegetation Tab, Jurisdictional Wetlands Input Form

3 WetlandsformInputMain - Microsoft Internet Explorer

File Edit View Favorites Tools Help

ISPP0002 | Data Entry Complete | N-T

[SPP] Go JD

Site Location	Vegetation	Hydrology	Soil Profile	Other Soil	Determination	Save Plot	Main Menu
<input checked="" type="checkbox"/> Recorded Data (Describe in Remarks): <input type="checkbox"/> Stream, Lake or Tide Gauge <input checked="" type="checkbox"/> Aerial Photographs (Years: 1978, 1990,) <input type="checkbox"/> Other <input type="checkbox"/> No Recorded Data Available						Hydrology Comments: A horizon very moist but not saturated	
						JURISDICTIONAL HYDROLOGY INDICATORS: Primary Indicators: <input type="checkbox"/> No Inundated <input type="checkbox"/> No Saturated <input type="checkbox"/> No Water Marks <input type="checkbox"/> No Drift Lines <input type="checkbox"/> No Sediment Deposits <input type="checkbox"/> No Oxidized Root Channels in Upper 12" <input type="checkbox"/> No Water-Stained Leaves <input type="checkbox"/> No Local Soil Survey Data <input type="checkbox"/> No FAC- Neutral Test <input type="checkbox"/> No Other (Explain in Comments)	
						JURISDICTIONAL REGIONAL SURVEYING INDICATORS: Depth Observations (N/A if None): Depth of Surface Water: <input type="text"/> N/A Depth to Free Waterface in Pt. H2O: <input type="text"/> N/A Ice: <input type="text"/> N/A Depth to Saturated Soil: <input type="text"/> N/A	
						Aspect (degrees): 150 (direction): Southeast Percent Slope: 2 % Elevation (ft): 1135 Landform: Hillside Macro-Topography: Concave Micro-Topography: <input type="text"/> HGM Class: Slope Waterbody Type: <input type="text"/> Specific Conductance: 0	
						Plot 4 of 4666 << previous 1 next >> Go To Next Tab	

[Done] Internet

FIGURE 19-10, Hydrology Tab, Jurisdictional Wetlands Input Form

FIGURE 19-11, Soil Profile Tab, Jurisdictional Wetlands Input Form

WetlandsformInputMain - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Soil Profile Tab @ 3:17:45 PM JEP Go SPP0002 Data Entry Complete

ID: N-T

Site Location Vegetation Hydrology Soil Profile Other Soil Determination Save Plot Main Menu

(COE 1597 MANUAL INDEX : COE INDICATORS)

Hydric Per 1987 COE Manual?

No <input type="checkbox"/> Histocol (16+*)	No <input type="checkbox"/> Gleyed or Low-Chroma Colors
No <input type="checkbox"/> Hist Epedon (8-16")	No <input type="checkbox"/> High Organic Content Surface Layer Sandy Soils
No <input type="checkbox"/> Sulfidic Odor	No <input type="checkbox"/> Organic Streaking in Sandy Soils
No <input type="checkbox"/> Aquatic Moisture Regime	No <input type="checkbox"/> Listed on Local Hydric Soils List
No <input type="checkbox"/> Reducing Conditions	No <input type="checkbox"/> Listed on National Hydric Soils List

OTHER SOIL FEATURES

Depth of Organic Mat (inches)	0
Depth to Permafrost (inches)	0
Major Rooting Zone (inches)	8
Soil Temperature (12" Below Surface)	41 F
No <input type="checkbox"/> Cryoturbated	No <input type="checkbox"/> Thixotropic

NRCS STITCHES

Hydric Per NRCS Field Taxonomy? 10 Add Rows

Year	Soil Code	Delete
		Delete

Profile Comment:

Plot 4 of 4568 << previous 1 next >> Go To Next Tab

FIGURE 19-12. Other Soil Tab, Jurisdictional Wetlands Input Form

WetlandsFormInptMain - Microsoft Internet Explorer

File Edit View Favorites Tools Help

ISPP Go JF BLT

13P0001 Data Entry Complete

Soil Profile Tab 3:17:45 PM

Site Location Vegetation Hydrology Soil Profile Other Soil Determination Save Plot Main Menu

Hydrophytic Vegetation Present? Yes FA Cross Reference Plot No:

Wetland Hydrology Present? No Site Marked on Map? Yes

Hydro Soils Present? Marginal Site Flagged? No

HGM Class. Slope

Remarks

Is This Sampling Point Within a Wetland? Yes

Pict Photographs Are Digital APS Res F

Midline Observations: None Engineering Concerns: None

WILDLIFE OBSERVATIONS:

Animal	Sign	Observation
Cervid	<input type="checkbox"/>	<input type="checkbox"/>
Bear	<input type="checkbox"/>	<input type="checkbox"/>
Wolf	<input type="checkbox"/>	<input type="checkbox"/>
Fox	<input type="checkbox"/>	<input type="checkbox"/>
Beaver	<input type="checkbox"/>	<input type="checkbox"/>
Ground Squirrel	<input type="checkbox"/>	<input type="checkbox"/>
Watertowl	<input type="checkbox"/>	<input type="checkbox"/>
Moose	<input type="checkbox"/>	<input type="checkbox"/>
Prairiehen	<input type="checkbox"/>	<input type="checkbox"/>
Game Trail	<input type="checkbox"/>	<input type="checkbox"/>

Plot 4 of 4666 << previous | 1 | next >> Photo Type: Vegetation Photo Bearing: SE

Mark As QC Complete Go To Next Tab

Done Internet

FIGURE 19-13, Determination Tab, Jurisdictional Wetlands Input Form

WetlandsFormInptMain - Microsoft Internet Explorer

File Edit View Favorites Tools Help

ISPP Go JF BLT

13P0001 Data Entry Complete

Site Location Vegetation Hydrology Soil Profile Other Soil Determination Assessment Save Plot Main Menu

Public Ownership: Private Ownership:

Wetland Management Area: Federally Managed Area:

Historical Wetland Area: Designated State or Federal Protected Wetland:

Documented Public or Local Sources: Recently Search Wetland Category:

Recreational Use Area: Subsistence Use Area:

Size: 1 acre(s)

Small (<10 acres) Medium (10-100 acres) Large (>100 acres)

Ratio of Wetland Area to Watershed Area: High (10%) Low (10%)

Wetland Anthropogenic: Converted up & downstream: Only connected above: Only connected below: Other wetland nearby, but not connected: Not connected:

Watershed Land Use: > 100% urbanized: 25-50% urbanized: 0-25% urbanized:

Wetland Land Use: High Intensity Agriculture: Moderate Intensity (forest): Low Intensity (open space):

Other Variables: Sealing: Historic Park:

Water pH: Acid (<5.5)

Wetland Water Regime: Viet. Perennial, permanently flooded, stemper flooded Viet. Seasonally flooded, temporary/flooded, saturated

Surface Water Level Fluctuation: High fluctuation Low fluctuation Never fluctuated

Frequency Overbank Flooding: >5 yrs. return interval 2-5 yrs. 1-2 yrs. No overbank flooding

Evidence of Sedimentation: No evidence Foulwater soil Sediment deposited substrate

Basin Topographic Gradient: High gradient (>2%) Low gradient (<2%)

Degree of Outlet Restriction: Restricted outlet Unrestricted outlet No outlet

Wetland Cluster Class: No natural outlet Natural outlet Human-made outlet Human-made and natural outlet Intermittent and seasonal outlet Intermittent and perennial outlet Preferred natural outlet Preferred intermittent outlet Preferred natural perennial outlet

Number of Types: 5 or more types 3-4 types 1-2 types

Type Diversity Options: Even distribution Moderately even distribution Highly uneven distribution

Vegetation Density/Romance: Sparse (0-20%) Low density (20-40%) Medium density (40-60%) High density (60-80%) Very high density (80-100%)

Vegetation Interspersion: High (mainly groups, dense and interspersed) Moderate (broken, irregular mats) Low (large patches, concentric rings)

Plant Species Diversity: Low (1-2 species sampled) Medium (3-4 species sampled) High (5 or more species sampled)

Proportion of Animal Food Plants: Low (5-25% cover) Medium (26-50% cover) High (51 or more cover)

Mark As QC Complete Go To Next Tab

Done Internet

', and 'Mark As QC Complete Go To Next Tab'. Status bars at the top show 'Data Entry Complete' and plot numbers."/>

FIGURE 19-14, Assessment Tab, Jurisdictional Wetlands Input Form

<http://www.pebbleproject.com/WetlandsPlotReport> Microsoft Internet Explorer

Pebble Gold Copper Project: Jurisdictional Wetland Plot Report

Plot Number: 3PP0010 QC Status: QC Complete
Type: JD Status: Y

Site Location:

Project Skel:	1	Date:	6/27/2004
Applicant/Owner:	Northern Dynasty Minerals, Inc.	County:	Lake & Peninsula Borough
Investigator(s):	Steve Rezema (SJR) Christopher Love (CJP)	State:	Alaska
Do I have Circumstances exist?	Yes	Watershed:	South Fork Kukpuk
Is the Site Significantly Disturbed (atypical)?	No	Community ID:	
Paper Plot Title No:	2145	Ortho ID:	Air Photo ID: 3-7
Is the Site a Potential Problem Area?	No	Township:	032 3S
Rangel:	35W 3SW (gns)	Range:	
Section:	33 33 (gns)	Section:	33 33 (gns)
Quadrat No:	LID7 LID7 (gns)	General location:	Bottom of slope west of Frying Pan Lake
Approximate Distance to Nearest Disturbance (ft):		Lat Long Elev (Frm):	59.5215 -155.18278 1152
Type of Disturbance (if any):		Lat Long Elev (GPS):	59.52085 -155.18095 0

Vegetation:

Scientific Name	Latin Name	Common Name	Stratum	Strat. Status	% Cover	Dam.	Trea Height	Trea DBH	Mature Stratum
BENI	Betula nana	Swamp Birch	S	FAC	1	N			SS
EMN	Eriogonum nudum	Black Crowberry	S	FAC	1	N			DS
LEDE	Lesqia decumbens	Narrow-Leaf Labrador-tea	S	FACW	1	N			DS
SAFU	Saxifraga bronchialis	Alpine Bog Willow	S	FACW	5				SS
SPBE	Spiraea beauverdiana	Beaverbed Spirea	S	FAC	1	N			SS
VADX	Vaccinium corymbosum	Small Cranberry	S	OBEL	1	N			DS
VALL	Vaccinium uliginosum	Egg Blueberry	S	FAC	1	N			DS
CARE	Carex sp.	Sedge	H		10				SH
EGFL	Equisetum fluviatile	Water Horsetail	H	OBEL	1	N			SH
ERSC	Eryngium scheuchzeri	Scheuchzer's Cotton-Grass	H	OBEL	10				SH
POPA1	Potentilla palustris	Marsh Cinquefoil	H	OBEL	15				SH
RUCH	Rubus chamaemorus	Cloudberry	H	FACW	1	N			SH
TREU	Trisetum europaeum	European Star-grass	H	FAC	1	N			SH
	Sphagnum sp.	Unlayered Sphagnum Moss	B		75	N			ML

% of Dominant Species that are OBEL, FACW, or FAC (excluding FAC-H): 75 Calculated: 75 %

Vegetation Remarks:

*By Stratum (Mature - Wetlands Only)

0EE = Canopy: 0 %	SAP = Sapling: 0 %	TG = Tall Shrub: 0 %	Field BBMP Veg Type:	Subsurface Lowland Sedge-Moss Bog Meadow (L2)
SS = Short Shrub: 8 %	DS = Dwarf Shrub: 6 %	TH = Tall Herb: 0 %	Field BBMP Veg Type:	Subsurface Lowland Sedge-Moss Bog Meadow (L2)
SH = Short Herb: 39.5 %	ML = Mose-Lichen: 75 %	F = Floating: 0 %	Field EBM Wet Code:	U
SUB = Submerged: 0 %	Number of Layers: 4		Field EBMV Code:	PENIB TO

Field EROS Veg Type: Subsurface Lowland Sedge-Moss Bog Meadow (L2)

Field EBM Wet Code: U

Field EBMV Code: PENIB TO

Field EROS Veg Type: Subsurface Lowland Sedge-Moss Bog Meadow

Eros GS: Coarse shrub - pruned

Trace = (%) 3 Method: 0/20 Stratum

Hydrology:

Recorded Data: Yes
Stream, Lake, or Tide Gauge: No
Aerial Photographs (Years: 1970, 1990, 2004)
Offset: No

TELLIN G. NENNA STATE - GR. 1200 ft

Depth of Surface Water: 0
Depth to Free Waterline in Pts: H2O:1 Ize:N/A
Depth to Saturated Soil: 0

Hydrology Comments:
Area is saturated. No surface water, but wet shoes when walking.

Aspect (degrees): 110 (direction): E
Percent Slope: 4
Elevation (ft): 1152
Landform: Slope
Topography: Concave
HGM Class: Slope

Soil Profile:

Soil Survey Map Unit Name: Field Drainage Class: Poorly Drained Field Taxonomy: Hydric Sphagnum/lept.

Soil Profile and Phaseless

Soil Profile Description: Colors moist unless otherwise noted

Depth	Name	Matrix	Feature	Color	Abundance	Struc	Contract	Coarse	Fine	Texture	Structure	Books	all	soil	water
0-10	O														

Comments:

Done

FIGURE 19-15, Jurisdictional Wetlands Plot Report, Part 1

DRAFT ENVIRONMENTAL BASELINES STUDIES, 2004 PROGRESS REPORT

DRAFT

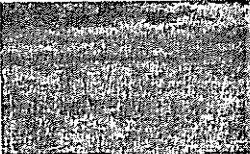
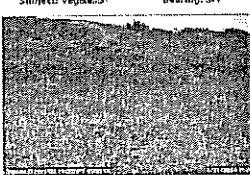
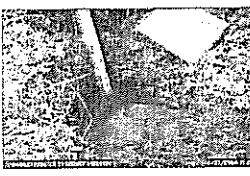
Soil Indicators:																																																	
Hydric Per 1987 COE Manual? Yes																																																	
Horizon (15-18") Yes	High Organic Content Surface Layer Sandy Soil: No																																																
Hydro Erosion (5-10") No	Organic Streaking in Sandy Soils: No																																																
Sulfur Odor Yes	Listed on Local Hydric Soil List: No																																																
Aqua Mixture Regime Yes	Listed on National Hydric Soil List: No																																																
Resinifer Content Yes	Cryostructure: No																																																
Dyed or Low-Cream Colors No	Intratropic: No																																																
 Hydric Per IBCS Field Taxonomy? Yes																																																	
<table border="1"> <thead> <tr> <th>Year</th> <th>Soil Code</th> </tr> </thead> <tbody> <tr> <td>1996</td> <td>A1</td> </tr> <tr> <td>1996</td> <td>A4</td> </tr> <tr> <td>2001</td> <td>1</td> </tr> <tr> <td>2004</td> <td>2</td> </tr> <tr> <td>2004</td> <td>3</td> </tr> </tbody> </table>		Year	Soil Code	1996	A1	1996	A4	2001	1	2004	2	2004	3																																				
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1996	A1																																																
1996	A4																																																
2001	1																																																
2004	2																																																
2004	3																																																
<p>Observation:</p> <p>Hydrophytic Vegetation Present? Yes</p> <p>Wetland Hydrology Present? Yes</p> <p>Hydric Soil Present? Yes</p> <p>Remarks:</p> <p>Wildlife Observations:</p> <p>Moose Scent</p> <table border="1"> <thead> <tr> <th>Animal</th> <th>Sign</th> <th>Observation</th> </tr> </thead> <tbody> <tr> <td>Cowbird</td> <td></td> <td></td> </tr> <tr> <td>Bear</td> <td></td> <td></td> </tr> <tr> <td>Wolf</td> <td></td> <td></td> </tr> <tr> <td>Fox</td> <td></td> <td></td> </tr> <tr> <td>Beaver</td> <td></td> <td></td> </tr> <tr> <td>Ground Squirrel</td> <td></td> <td></td> </tr> <tr> <td>Veteroway</td> <td></td> <td></td> </tr> </tbody> </table>		Animal	Sign	Observation	Cowbird			Bear			Wolf			Fox			Beaver			Ground Squirrel			Veteroway																										
Animal	Sign	Observation																																															
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Ground Squirrel																																																	
Veteroway																																																	
<p>FA Cross Reference Plot No:</p> <p>Site Marked on Map? Yes</p> <p>Site Flagged? No</p> <p>Is This Sampling Point Within a Wetland? Yes</p> <p>Plot Photographs Are: Digital</p> <p>APS Roll #: 1</p>																																																	
<p>Engineering Concerns:</p>  <p>Subject: Vegetation Bearing: SW</p>  <p>Subject: Vegetation Bearing: N</p>  <p>Subject: Soils Bearing: NW</p>																																																	
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FIGURE 19-16, Jurisdictional Wetlands Plot Report, Part 2

Pebble Gold Copper Project: Master Plant List

Search Criteria:

Watershed(s): Pile Bay
Firm(s): HDR

Master Plant List:

[Export to Excel](#)

Latin Name	Common Name	Stratum	Magee Stratum	Ind. 1995	Ind. 1988
<i>Betula kenaica</i>	Kenai Birch	T/S	TREE		FACU
<i>Picea glauca</i> (Trees)	White Spruce (Trees)	T	TREE		FACU
<i>Alnus sinuata</i> (shrub)	Sitka Alder (shrub)	S	TS		FAC
<i>Andromeda polifolia</i>	Bog Rosemary	S	DS		OBL
<i>Betula nana</i>	Swamp Birch	S	SS		FAC
<i>Empetrum nigrum</i>	Black Crowberry	S	DS		FAC
<i>Ledum decumbens</i>	Narrow-Leaf Labrador-Tea	S	DS		FACW
<i>Linnaea borealis</i>	Twinsflower	S	DS	FACU	UPL
<i>Menziesia ferruginea</i>	Mock-Azalea	S	SS	FACU*	UPL
<i>Picea glauca</i> (Saplings)	White Spruce (Saplings)	S	SAP		FACU
<i>Potentilla fruticosa</i>	Shrubby Cinquefoil	S	SS		FAC
<i>Ribes laxiflorum</i>	Trailing Black Currant	S	SS		NL
<i>Salix barclayi</i>	Barclay Willow	S	SS		FAC
<i>Salix fuscescens</i>	Alaska Bog Willow	S	SS		FACW
<i>Salix pulchra</i>	Diamond-Leaf Willow	S	SS		FACW
<i>Sorbus sitchensis</i>	Mountain-Ash	S	SS	FACU*	NL
<i>Spiraea beauverdiana</i>	Beauverd's Spiraea	S	SS		FAC
<i>Vaccinium microcarpus</i>	Blueberry	S	DS		OBL
<i>Vaccinium ovalifolium</i>	Early Blueberry	S	SS		FAC
<i>Vaccinium uliginosum</i>	Bog Blueberry	S	DS		FAC
<i>Vaccinium vitis-idaea</i>	Mountain Cranberry	S	DS		FAC
<i>Viburnum edule</i>	Squashberry	S	SS		FACU
<i>Achillea borealis</i>	Yarrow	H	SH		NL
<i>Calamagrostis canadensis</i>	Blue-Joint Reedgrass	H	SH		FAC
<i>Carex aquatilis</i>	Water Sedge	H	SH		OBL
<i>Carex canescens</i>	Hoary Sedge	H	SH		OBL
<i>Carex lyngbyei</i>	Lyngbye's Sedge	H	SH		OBL
<i>Carex pauciflora</i>	Few-Flower Sedge	H	SH		OBL
<i>Carex phyllospadix</i>	Coastal Stellate Sedge	H	SH		OBL
<i>Carex pluriflora</i>	Several Flowered Sedge	H	SH		OBL
<i>Carex ruficola</i>	Loose Flowered Sedge	H	SH		OBL
<i>Carex saxatilis</i>	Russet Sedge	H	SH		FACW
<i>Carex sp.</i>	Sedge	H	SH		
<i>Cornus suecica</i>	Swedish Dwarf Bawnnd	H	SH		FAC

FIGURE 19-17, Master Plant List Report

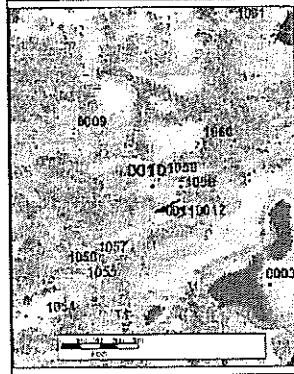
3 Wetlands Field Photo Report - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Pebble Gold Copper Project: Jurisdictional Wetland Determination Photo Report

Plot Number: 3PP0010 ▾
Wetland Status: Y
[Export To Word](#)

Field Investigators:	Christopher Love (3PP) Steve Reidsma (3PP)
USGS Quad:	IUD7 GPS: IUD7
Township:	03S GPS: 3S
Range:	35W GPS: 35W
Section:	33 GPS: 33
Watershed:	South Fork Koktuli GPS:
Landform:	Swale
Topography:	Concave
Aspect:	118 degrees Direction: E
Percent Slope:	4
Elevation Range:	1152



Hydrology & Soils

Depth to Saturated Soils (inches):	0
Depth to Free Water in Pit (inches):	1
Primary Hydrology Indicators:	None
Secondary Hydrology Indicators:	None
HGM Class:	Slope
Depth of Organic Material:	19
1987 Manual Hydric Soil Indicators:	None
Hydric Per 1987 Manual:	Yes
Hydric Per NRCS Field Taxonomy:	Yes
Soil Field Drainage Class:	PD

Soil Profile Picture



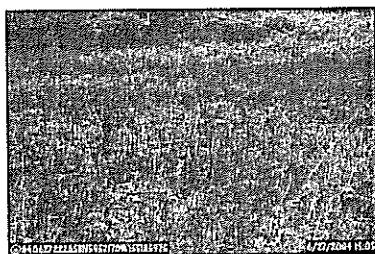
Field Taxonomy:

Dominant Plants by Stratum:

Tree: None	Shrub: None	Herbaceous: None
------------	-------------	------------------

Percent of Dominant Species that are OBL, FACW, or FAC: 75%

Vegetation Picture 1



Vegetation Picture 2



FIGURE 19-18, Jurisdictional Wetland Determination Photo Report

Species Composition:										
Export to Excel										
Latin Name	Common Name	Stratum	Mature Stratum	Ind. 1995	Ind. 1988	Percent Cov.	Std. Dev.	Freq.	Avg. Height	Avg. DBH
<i>Betula occidentalis</i> (Trees)	Paper Birch (Trees)	T	TREE		FACU	13.30% (14.3% avg)	114.01%	16	12' 0"	5' 0"
<i>Picea glauca</i> (Trees)	White Spruce (Trees)	T	TREE		FACU	13.20% (5.9% avg)	14.64%	57	10' 1"	13' 2"
<i>Picea mariana</i> (Snags)	Black Spruce (Snags)	T	TREE		N/A	10.15% (11.7% avg)	2.89%	4	"	"
<i>Picea mariana</i> (Trees)	Black Spruce (Trees)	T	TREE		FACW	5.5% (5.0% avg)	19.00%	2	"	"
<i>Picea sitchensis</i>	Sitka Spruce	T	TREE		FACU	1%	5%	0	"	"
<i>Populus balsamifera</i> (Trees)	Cottonwood (Trees)	T	TREE		FACU	1%	5%	1	"	"

Shrubs:										
Export to Excel										
Latin Name	Common Name	Stratum	Mature Stratum	Ind. 1995	Ind. 1988	Percent Cov.	Std. Dev.	Freq.		
<i>Aronia spinosa</i> (shrub)	Silk Alder (shrub)	IS	ITS		FACU	13.65% (15.7% avg)	18.91%	54		
<i>Anemone radula</i>	Big Rosemary	IS	IDS		DEL	3.35% (9.7% avg)	8.10%	121		
<i>Arcostaphylos alnina</i>	Alpine Manzanita	IS	IDS		FACU	3.15% (6.4% avg)	3.63%	26		
<i>Arcostaphylos alnina</i> var. <i>rubra</i>	Alpine Manzanita	IS	IDS		FAC*	1%	1%	1		
<i>Artemisia triseta</i>	Salalbrush	IS	IDS		INL	3.3% (3.0% avg)	0.00%	5		
<i>Betula glandulosa</i>	Tundra Dwarf Birch	IS	ISS		FAC	5.55% (11.7% avg)	11.55%	5		
<i>Betula nana</i>	Swamp Birch	IS	ISS		FAC	3.50% (11.7% avg)	7.94%	25		
<i>Dipsosaurus dorsalis</i>		IS	IDS	UPL*	INL	5.5% (5.0% avg)	0.00%	1		
<i>Dryas drummondii</i>	Yellow Mountain-Aven	IS	IDS		FACU	1%	1%	1		
<i>Eriogonum comosum</i>	Black Crowberry	IS	IDS		FAC	3.65% (13.1% avg)	10.45%	192		
<i>Halimis edulis</i>	Pale Laurel	IS	IDS		FACW	4.15% (6.9% avg)	3.97%	27		
<i>Ledum decumbens</i>	Narrow-Leaf Labrador-Tea	IS	DS		FACW	3.60% (14.1% avg)	11.45%	166		
<i>Ledum groenlandicum</i>	Greenland Labrador-Tea	IS	IDS		FACW	4.30% (11.9% avg)	9.45%	12		
<i>Linnæa borealis</i>	Thimbleberry	IS	IDS	FACU	UPL	1%	1%	1		
<i>Linoclelea procumbens</i>	Alpine Azalea	IS	IDS		INL	3.3% (3.0% avg)	1.00%	9		
<i>Myrica gale</i>	Swampale	IS	ISS		DEL	3.75% (21.7% avg)	15.43%	39		
<i>Picea glauca</i> (Saplings)	White Spruce (Saplings)	I	ISAP		FACU	3.10% (6.5% avg)	4.95%	20		
<i>Potentilla fruticosa</i>	Shrubby Cinquefoil	IS	SS		FAC	3.40% (13.6% avg)	11.33%	37		
<i>Rubus sp</i>	Currant	IS	SS			1%	1%	1		
<i>Rosa acicularis</i>	Prickly Rose	IS	SS		FACU	1%	1%	1		
<i>Rubus spectabilis</i>	Salmon Berry	IS	SS		FACU	1%	1%	1		
<i>Salix glauca</i>	Felt-Leaf Willow	IS	TREE		FAC	3.80% (23.3% avg)	29.09%	20		
<i>Salix alba</i>	Little-Tree Willow	IS	TS		FACW	1%	1%	1		
<i>Salix arctica</i>	Arctic Willow	IS	IDS		FAC	3.40% (12.6% avg)	13.09%	5		

FIGURE 19-19, Plant Community Report

Model	Model 3: Storm and Flood Water Storage
Plot Number	3P003I
HGM Type	0/4/4
Date	24/05/2005 1:04:00 PM
Variable	
Indicators Of Distunction	No Indicators of Distunction found
Indicators Of Function	No Indicators of Function found
Primary Variables	No Primary Variables found
Total Score	0
Model Range	0 - 0
Index Range	0.00 - 1.00
Functional Capacity Index	0.00
Neither a direct indicator of function nor a indicator of dysfunction was present in the wetland being assessed. Therefore, the functions primary variables were used to obtain the final index.	

FIGURE 19-20, Wetlands Functional Assessment Report

The screenshot shows a Microsoft Internet Explorer window with the following details:

- Title Bar:** Northern Dynasty Mines Inc. - Pebble Project
- Menu Bar:** File, Edit, View, Favorites, Tools, Help
- Toolbar:** Back, Forward, Stop, Refresh, Favorites, Media
- Address Bar:** Address
- Content Area:**
 - Pebble Links Table:** A list of links categorized into Associations, Corporate, General Information and Publications, and Government.
 - Associations:** Alaska Native Association, Alaska Federation of Natives, National Mining Association, Resource Development Council, Alaska Department of Natural Resources, and the Alaska Native Alliance.
 - Corporate:** Barrick Gold Corporation, Northern Dynasty Minerals Ltd.
 - General Information and Publications:** Alaska & World Economic and Mining News, ArcticNet, ArcticNet Map, Alaska Data Information Forum, Alaska Economic Council, and Governor Steve. R. W. J. Walker.
 - Government:** Alaska Department of Labor, Alaska Department of Environment and Energy, Alaska Department of Natural Resources, Alaska Department of Fish and Game, Alaska Department of Health and Social Services, Alaska Department of Natural Resources, Alaska Department of Transportation and Public Facilities, Environmental Emergency Agency, Northern Region and Aleutian Region Administrators, Northwest Region, Office of Alaska, and U.S. Army Corps of Engineers - Alaska East.

FIGURE 19-21, Pebble Links Table

The screenshot shows a Microsoft Internet Explorer window with the following details:

- Title Bar:** Physical Characterization > Field Data Sheet > Microsoft Internet Explorer
- Menu Bar:** File, Edit, View, Favorites, Tools, Help
- Toolbar:** Back, Forward, Stop, Refresh, Favorites, Media
- Address Bar:** Address
- Form Fields:**

Location: Bear Den Creek	Classification: Stream Type	Odors: None	Odors: Surface Oils																																
Date: 09/7/2004	Stream Type: Stained	Sight	Est. Turbidity																																
Company: HDR	Other: Petroleum	Moderate	Clean																																
Stream: Bear Den Creek	Aerobic	Protozoa	Stained																																
River Basin:	Other		Slightly turbid																																
Collected by: [Redacted]			Turbid																																
Gradient: [Redacted]	change in height over 25m (82 ft.)																																		
	%																																		
<input type="checkbox"/> Reconnaissance <input type="checkbox"/> Holistic <input type="checkbox"/> Fish <input type="checkbox"/> Macroinvertebrate <input type="checkbox"/> Flow <input type="checkbox"/> V.O. <input type="checkbox"/> Periphyton <input type="checkbox"/> Sediment																																			
<input type="checkbox"/> Add Records <input type="checkbox"/> Delete Rows <input type="checkbox"/> Discharge Rosen Class: [Redacted] Substrate: Low Gradient-Coarse [Redacted] Hgt Water Met: 0.5 m <input type="checkbox"/> NEW <input type="checkbox"/> REV Velocity: [Redacted] msec [Redacted] msec [Redacted] msec Average: [Redacted] msec																																			
100% of the sample is made up of the following: <table border="1"> <thead> <tr> <th>Type</th> <th>Diameter</th> <th>Percent</th> <th>Composition in Reach (>100%)</th> </tr> </thead> <tbody> <tr> <td>Bedrock</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Boulder</td> <td>>255 mm (10 in)</td> <td>[Redacted]</td> <td></td> </tr> <tr> <td>Cobble</td> <td>64-255 mm (2.5-10 in)</td> <td>[Redacted]</td> <td></td> </tr> <tr> <td>Gravel</td> <td>2-64 mm (0.1-2.5 in)</td> <td>[Redacted]</td> <td></td> </tr> <tr> <td>Sand</td> <td>0.06-2 mm (gritty)</td> <td>[Redacted]</td> <td></td> </tr> <tr> <td>Silt</td> <td>0.004-0.05 mm</td> <td>[Redacted]</td> <td></td> </tr> <tr> <td>Clay</td> <td><0.005 mm (slick)</td> <td>[Redacted]</td> <td></td> </tr> </tbody> </table> Pebble count complete? <input checked="" type="checkbox"/> Y				Type	Diameter	Percent	Composition in Reach (>100%)	Bedrock				Boulder	>255 mm (10 in)	[Redacted]		Cobble	64-255 mm (2.5-10 in)	[Redacted]		Gravel	2-64 mm (0.1-2.5 in)	[Redacted]		Sand	0.06-2 mm (gritty)	[Redacted]		Silt	0.004-0.05 mm	[Redacted]		Clay	<0.005 mm (slick)	[Redacted]	
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Silt	0.004-0.05 mm	[Redacted]																																	
Clay	<0.005 mm (slick)	[Redacted]																																	

FIGURE 19-22, Field Form Example, Physical Characterization

Data Loader Main Menu

DataLoader Name: [Chemical] 2004 Shaw Chemistry Loader	
New Data Loader	Define a new data loader
Edit Existing Loader	Edit selected data loader
Delete Data Loader	Delete selected data loader.
View Loader History	Enables a user to search through a history log of old data loads and find a previously loaded batch
Load Data	Allows user to upload a new data file or select a currently uploaded file and load the data into the database
Reload Data	Allows user to reload data batches that have previously been loaded into the database

FIGURE 19-23, Data Loader Menu

Edit Electronic Data Definition

Name:	Shaw Test Loader
Type:	Chemical
Template:	Shaw 2004 Headers.xls
Upload Template:	<input type="button" value="Browse..."/> <input type="button" value="Upload File"/>
Company:	Shaw Environmental
Column Match:	Columns have been selected <input type="button" value="Match Columns"/>
<input type="button" value="Save"/> <input type="button" value="Cancel"/>	

FIGURE 19-24, Editing or Defining Data Definition

S:\Data\loader\Upload\data\interview\Tables\matrix.xls

File Edit View Favorites Tools Help

Back Search Favorites Media Links Go

Address

Northern Dynasty Mines Inc - Pebble Project

Home Document Repository Calendar Contacts Logistics Wetlands Links Field Forms Analytical Data GIS Map Admin Logout

Upload Results: Load Successful
Date/Time: 2/4/2005 5:43:34 PM
EDD: Jth temp
Company: Shaw Environmental

Username: Jeanne
Uploaded File: 02 - 04JulCH2M_RDI Nov20 Test File.xls
Action: Load

Exit Print

Field Results

RECEIPTID	ANHCODE	MATRIX	QC CODE	TOTAL
131	E1631	W6	CS	10

Lab Results

RECEIPTID	ANHCODE	MATRIX	QC CODE	TOTAL
131	A1500CL	W6	BS1	1
131	A1500CN	W6	BC1	1
131	A1500M	W6	BS1	1
131	E1201	W6	BS1	1
131	E1501	W6	BS1	1
131	E1601	W6	BC1	1
131	E1602	W6	BS1	1
131	E3000	W6	BS1	1
131	E3101	W6	BS1	1
131	E3501	W6	BS1	1
131	E3502	W6	BS1	1
131	E3653	W6	BS1	1

Done Local Intranet

FIGURE 19-25, Data Loader History

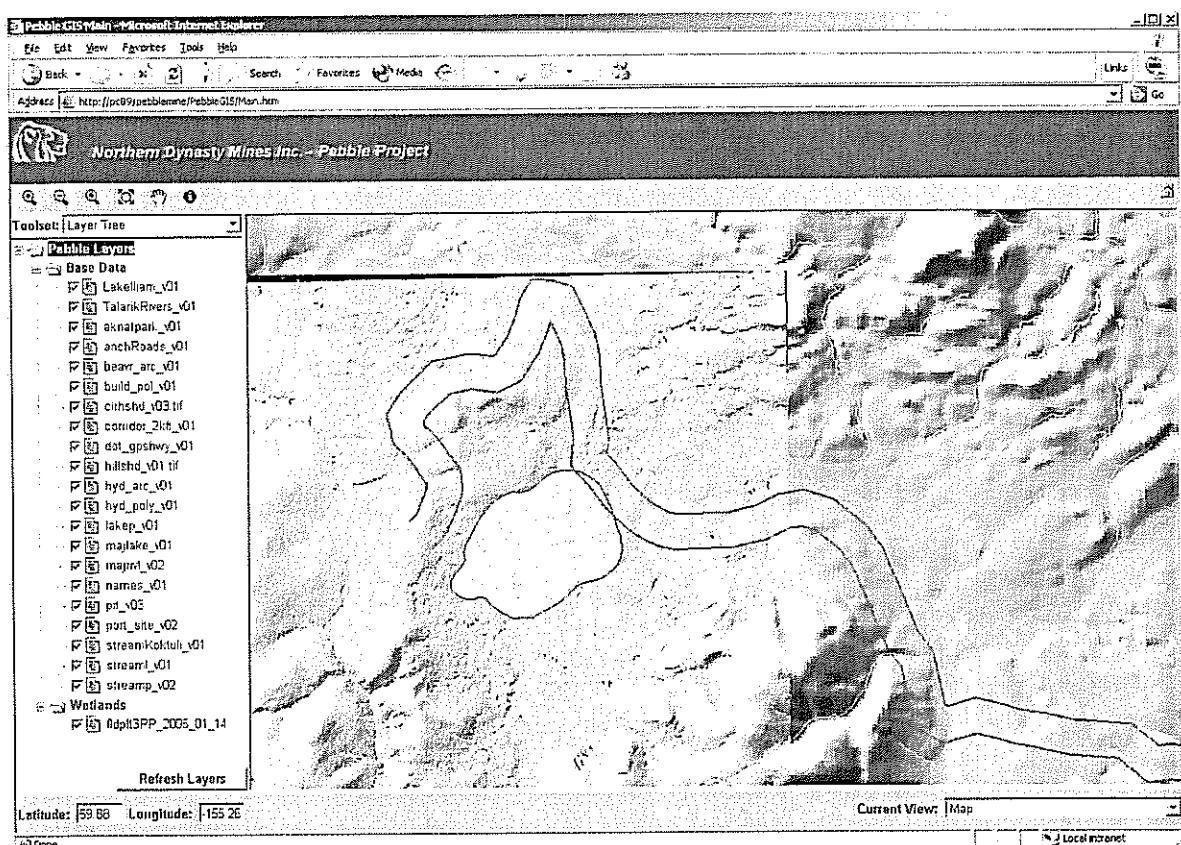


FIGURE 19-26, GIS Map

EPA-9498-0000205